Claims

We Claim:

A wavelength-selective optical transmission system comprising: 5 a first waveguide for transmitting a multiplexed optical signal therethrough; a second waveguide coupled to said first waveguide wherein a least one of said first and second waveguides having a set of · 10 wavelength-selective Bragg gratings disposed near a coupling section between said first and second waveguides to reflect a reflecting optical signal back to said first waveguide and for transmitting a contra-directional optical signal and a co-directional 15 optical signal having respectively a contra-directional selected wavelength and a co-directional selected wavelength corresponding to said Bragg gratings wherein one of said contra-directional and co-directional wavelengths is chosen as a designated wavelength, and said reflecting optical signal and one of said contra-directional or co-directional optical signals are 20 outside of a predefined range surrounding said designated wavelength. 2 The wavelength-selective optical transmission system of claim 1 25 wherein: said first waveguide and said second waveguide have two different propagation constants. The wavelength-selective optical transmission system of claim 1 30 wherein: said first waveguide and said second waveguide composing of two different materials.

4. The wavelength-selective optical transmission system of claim 1
35 wherein:
said Bragg gratings disposed on said first waveguide.

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5. wherein:	The wavelength-selective optical transmission system of claim 1
	said Bragg gratings disposed on said second waveguide.
6. wherein:	The wavelength-selective optical transmission system of claim 1
	said Bragg gratings disposed on said first and second waveguides.
7. wherein:	The wavelength-selective optical transmission system of claim 1
٠	said Bragg gratings disposed on a cladding surrounding said first waveguide.
8. wherein:	The wavelength-selective optical transmission system of claim 1
	said Bragg gratings disposed on a cladding surrounding said second waveguide.
9. wherein:	The wavelength-selective optical transmission system of claim 1
	said Bragg gratings disposed on a cladding in a gap between said first and second waveguides.
10	. The wavelength-selective optical transmission system of claim 1

25 wherein:

said Bragg gratings comprising a periodic variation of a refraction of a refracti

said Bragg gratings comprising a periodic variation of a refractive index of an optical propagation material.

11. The wavelength-selective optical transmission system of claim 1
30 wherein:
said Bragg gratings comprising a periodic variation of a structural characteristic of an optical propagation material.

12. The wavelength-selective optical transmission system of claim 1 wherein:

said Bragg gratings comprising a periodic variation of a structural characteristic and a refractive index of an optical propagation material.

13. The wavelength-selective optical transmission system of claim 1 wherein:

at least one of said first and second waveguides are manufactured on a substrate by applying an integrated circuit (IC) manufacturing process thereon.

14. The wavelength-selective optical transmission system of claim 1 wherein:

said predefined range of wavelength surrounding said designated selected wavelength having a wavelength range between λ min and λ max and said first and second waveguide having an optical propagation constant of β_1 and β_2 respectively.

15. The wavelength-selective optical transmission system of claim 14 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_1 < \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \max\left(\frac{2\beta_1}{\beta_1 + \beta_2}, \frac{\beta_2 - \beta_1}{\beta_1 + \beta_2}\right)$.

16. The wavelength-selective optical transmission system of claim 14 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_1 > \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \max\left(\frac{\beta_1 + \beta_2}{2\beta_1}, \frac{\beta_1 - \beta_2}{\beta_1 + \beta_2}\right)$.

17. The wavelength-selective optical transmission system of claim 14 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 < \beta_2$ and

$$\frac{\lambda_{\min}}{\lambda_{\max}} > \min \left[\max \left(\frac{2\beta_1}{\beta_2 - \beta_1}, \frac{\beta_2 - \beta_1}{\beta_2 + \beta_1} \right), \frac{\beta_2 - \beta_1}{2\beta_1} \right].$$

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18. The wavelength-selective optical transmission system of claim 14 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 > \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_1 - \beta_2}{\beta_1 + \beta_2}$.

19. The wavelength-selective optical transmission system of claim 14 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_2 > 3\beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2 - \beta_1}{\beta_1 + \beta_2}$.

20. The wavelength-selective optical transmission system of claim 14 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_1 < \beta_2 < 3\beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{2\beta_1}{\beta_1 + \beta_2}$.

21. The wavelength-selective optical transmission system of claim 14 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $(\sqrt{5}-2)\beta_1 < \beta_2 < \beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_1 + \beta_2}{2\beta_1}$.

22. The wavelength-selective optical transmission system of claim 14 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_2 < (\sqrt{5} - 2)\beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2 - \beta_1}{\beta_2 + \beta_1}$.

23. The wavelength-selective optical transmission system of claim 14 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\left(\sqrt{5}-2\right)\beta_2 < \beta_1 < \frac{\beta_2}{3}$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{2\beta_1}{\beta_2 - \beta_1}$.

24. The wavelength-selective optical transmission system of claim 14 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 < (\sqrt{5} - 2)\beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2 - \beta_1}{\beta_2 + \beta_1}$.

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25. The wavelength-selective optical transmission system of claim 14 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\frac{\beta_2}{3} < \beta_1 < \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2 - \beta_1}{2\beta_1}$.

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26. The wavelength-selective optical transmission system of claim 14 wherein:

27. The wavelength-selective optical transmission system of claim 1

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 > \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_1 - \beta_2}{\beta_1 + \beta_2}$.

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wherein:

core.

said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a SiRN

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28. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a Si core.

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29. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a SiO_xN_y core.

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30. The wavelength-selective optical transmission system of claim 1 wherein:

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said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a $\rm Si_3N_4$ core.

31. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a Ta_2O_5 & SiO₂ core.

32. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a SiO2 cladding and a doped SiO_xN_y core and said second waveguide have a SiO2 cladding and a SiRN core.

33. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a SiO2 cladding and a doped SiO_xN_y core and said second waveguide have a SiO2 cladding and a Si core.

34. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a SiO2 cladding and a doped SiO_xN_y core and said second waveguide have a SiO2 cladding and a SiO_xN_y core.

35. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a SiO2 cladding and a doped SiO $_x$ N $_y$ core and said second waveguide have a SiO2 cladding and a Ta $_2$ O $_5$ & SiO $_2$ core.

36. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a first doped SiO₂ cladding and a doped SiO₂ core of different dopant concentration than said first doped SiO₂ cladding and said second waveguide have a second doped SiO₂ cladding and a SiRN core.

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37. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a first doped SiO₂ cladding and a doped SiO₂ core of different dopant concentration than said first doped SiO₂ cladding and said second waveguide have a second doped SiO₂ cladding and a Si core.

38. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a first doped SiO₂ cladding and a doped SiO₂ core of different dopant concentration than said first doped SiO₂ cladding and said second waveguide have a second doped SiO₂ cladding and a SiO_xN_y core.

39. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a first doped SiO₂ cladding and a doped SiO₂ core of different dopant concentration than said first doped SiO₂ cladding and said second waveguide have a second doped SiO₂ cladding and a Si₃N₄ core.

40. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a first doped SiO_2 cladding and a doped SiO_2 core of different dopant concentration than said first doped SiO_2 cladding and said second waveguide have a second doped SiO_2 cladding and a Ta_2O_5 & SiO_2 core.

41. The wavelength-selective optical transmission system of claim 1 wherein:

said first waveguide having a first doped SiO₂ cladding and a SiO_xN_y core and said second waveguide have a second doped SiO₂ cladding and a SiRN core.

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42. The wavelength-selective optical transmission system of claim 1 wherein: said first waveguide having a first doped SiO, cladding and a SiO_xN_y core and said second waveguide have a second doped SiO_x 5 cladding and a Si core. 43. The wavelength-selective optical transmission system of claim 1 wherein: said first waveguide having a first doped SiO2 cladding and a 10 SiO₂N₂ core and said second waveguide have a second doped SiO₂ cladding and a SiO_xN_y core. 44. The wavelength-selective optical transmission system of claim 1 wherein: 15 said first waveguide having a first doped SiO, cladding and a SiO_xN_y core and said second waveguide have a second doped SiO_x cladding and a Si₃N₄ core. 45. The wavelength-selective optical transmission system of claim 1 20 wherein: said first waveguide having a first doped SiO, cladding and a SiO_xN_y core and said second waveguide have a second doped SiO, cladding and a Ta,O₅ & SiO, core. 25 46. A wavelength-selective optical transmission system comprising: a first waveguide for transmitting a multiplexed optical signal therethrough; 30 a second waveguide coupled to said first waveguide wherein at least one of said first and second waveguides having a set of wavelength-selective Bragg gratings disposed near a coupling

section between said first and second waveguides wherein said

first and second waveguides having different propagation

constants.

	47. The wavelength-selective optical transmission system of claim 46
	wherein:
5	said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a SiRN core.
	48. The wavelength-selective optical transmission system of claim 46 wherein:
10	said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a Si core.
	49. The wavelength-selective optical transmission system of claim 46 wherein:
15	said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a SiO _x core.
20	50. The wavelength-selective optical transmission system of claim 46 wherein:
	said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a Si ₃ N core.
25	51. The wavelength-selective optical transmission system of claim 46 wherein:
	said first waveguide having a SiO2 cladding and a doped SiO2 core and said second waveguide have a SiO2 cladding and a Ta_2C & SiO_2 core.
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	52. The wavelength-selective optical transmission system of claim 46 wherein:
	said first waveguide having a SiO2 cladding and a doped SiO_xN_y core and said second waveguide have a SiO2 cladding and a SiRN
35	core.

53. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a SiO2 cladding and a doped SiO_xN_y core and said second waveguide have a SiO2 cladding and a Si core.

54. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a SiO2 cladding and a doped SiO_xN_y core and said second waveguide have a SiO2 cladding and a SiO_xN_y core.

55. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a SiO2 cladding and a doped SiO_xN_y core and said second waveguide have a SiO2 cladding and a Ta_2O_5 & SiO₂ core.

56. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a first doped SiO₂ cladding and a doped SiO₂ core of different dopant concentration than said first doped SiO₂ cladding and said second waveguide have a second doped SiO₂ cladding and a SiRN core.

57. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a first doped SiO₂ cladding and a doped SiO₂ core of different dopant concentration than said first doped SiO₂ cladding and said second waveguide have a second doped SiO₂ cladding and a Si core.

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58. The wavelength-selective optical transmission system of claim 46 wherein:

> said first waveguide having a first doped SiO2 cladding and a doped SiO, core of different dopant concentration than said first doped SiO, cladding and said second waveguide have a second doped SiO, cladding and a SiO_xN_y core.

59. The wavelength-selective optical transmission system of claim 46 wherein:

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said first waveguide having a first doped SiO, cladding and a doped SiO, core of different dopant concentration than said first doped SiO, cladding and said second waveguide have a second doped SiO, cladding and a Si₃N₄ core.

60. The wavelength-selective optical transmission system of claim 46 wherein:

> said first waveguide having a first doped SiO, cladding and a doped SiO₃ core of different dopant concentration than said first doped SiO, cladding and said second waveguide have a second doped SiO₂ cladding and a Ta₂O₅ & SiO₂ core.

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61. The wavelength-selective optical transmission system of claim 46 wherein:

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said first waveguide having a first doped SiO2 cladding and a SiO₁N₁ core and said second waveguide have a second doped SiO₂ cladding and a SiRN core.

62. The wavelength-selective optical transmission system of claim 46 wherein:

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said first waveguide having a first doped SiO2 cladding and a SiO_xN_v core and said second waveguide have a second doped SiO₂ cladding and a Si core.

63. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a first doped SiO_2 cladding and a SiO_xN_y core and said second waveguide have a second doped SiO_2 cladding and a SiO_xN_y core.

64. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a first doped SiO₂ cladding and a SiO_xN_y core and said second waveguide have a second doped SiO₂ cladding and a Si₃N₄ core.

65. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide having a first doped SiO_2 cladding and a SiO_xN_y core and said second waveguide have a second doped SiO_2 cladding and a Ta_2O_5 & SiO_2 core.

66. The wavelength-selective optical transmission system of claim 46 wherein:

said Bragg gratings reflecting an optical signal back to said first waveguide and transmitting a contra-directional optical signal and a co-directional optical signal having respectively a contra-directional selected wavelength and a co-directional selected wavelength corresponding to said Bragg gratings wherein one of said contra-directional and co-directional wavelengths is chosen as a designated wavelength, and said reflecting optical signal and one of said contra-directional or co-directional optical signals are outside of a predefined range surrounding said designated wavelength.

67. The wavelength-selective optical transmission system of claim 46 wherein:

said first waveguide and said second waveguide are composed of two different materials.

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68. The wavelength-selective optical transmission system of claim 46
wherein:
said Bragg gratings disposed on said first waveguide.
69. The wavelength-selective optical transmission system of claim 46 wherein:
said Bragg gratings disposed on said second waveguide.
70. The wavelength-selective optical transmission system of claim 46

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wherein:
said Bragg gratings disposed on said first and second waveguides.

71. The wavelength-selective optical transmission system of claim 46 wherein:

said Bragg gratings disposed on a cladding surrounding said first waveguide.

72. The wavelength-selective optical transmission system of claim 46 wherein:

said Bragg gratings disposed on a cladding surrounding said second waveguide.

73. The wavelength-selective optical transmission system of claim 46 wherein:

said Bragg gratings disposed on a cladding in the gap between said first and second waveguides.

74. The wavelength-selective optical transmission system of claim 66 wherein:

said predefined range of wavelength surrounding said designated selected wavelength having a wavelength range between λ min and λ max and said first and second waveguide having an optical propagation constant of β_1 and β_2 respectively.

75. The wavelength-selective optical transmission system of claim 74 wherein:

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said contra-directional wavelength is chosen as said designated wavelength and $\beta_1 < \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > max \left(\frac{2\beta_1}{\beta_1 + \beta_2}, \frac{\beta_2 - \beta_1}{\beta_1 + \beta_2} \right)$.

76. The wavelength-selective optical transmission system of claim 74 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_1 > \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \max\left(\frac{\beta_1 + \beta_2}{2\beta_1}, \frac{\beta_1 - \beta_2}{\beta_1 + \beta_2}\right)$.

77. The wavelength-selective optical transmission system of claim 74 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 < \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > min \left[max \left(\frac{2\beta_1}{\beta_2 - \beta_1}, \frac{\beta_2 - \beta_1}{\beta_2 + \beta_1} \right), \frac{\beta_2 - \beta_1}{2\beta_1} \right].$

78. The wavelength-selective optical transmission system of claim 74 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 > \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_1 - \beta_2}{\beta_1 + \beta_2}$.

79. The wavelength-selective optical transmission system of claim 74 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_2 > 3\beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2 - \beta_1}{\beta_1 + \beta_2}$.

80. The wavelength-selective optical transmission system of claim 74 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_1 < \beta_2 < 3\beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{2\beta_1}{\beta_1 + \beta_2}$.

81. The wavelength-selective optical transmission system of claim 74 wherein:

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said contra-directional wavelength is chosen as said designated wavelength and $(\sqrt{5}-2)\beta_1 < \beta_2 < \beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_1 + \beta_2}{2\beta_1}$.

82. The wavelength-selective optical transmission system of claim 74 wherein:

said contra-directional wavelength is chosen as said designated wavelength and $\beta_2 < (\sqrt{5} - 2)\beta_1$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2 - \beta_1}{\beta_2 + \beta_1}$.

83. The wavelength-selective optical transmission system of claim 74 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\left(\sqrt{5}-2\right)\beta_2 < \beta_1 < \frac{\beta_2}{3}$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{2\beta_1}{\beta_2-\beta_1}$.

84. The wavelength-selective optical transmission system of claim 74 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 < \left(\sqrt{5}-2\right)\!\beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2-\beta_1}{\beta_2+\beta_1}$.

85. The wavelength-selective optical transmission system of claim 74 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\frac{\beta_2}{3} < \beta_1 < \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_2 - \beta_1}{2\beta_1}$.

86. The wavelength-selective optical transmission system of claim 74 wherein:

said co-directional wavelength is chosen as said designated wavelength and $\beta_1 > \beta_2$ and $\frac{\lambda_{min}}{\lambda_{max}} > \frac{\beta_1 - \beta_2}{\beta_1 + \beta_2}$.

	87. The wavelength-selective optical transmission system of claim 46
	wherein:
	said Bragg gratings comprising a periodic variation of a refractive
	index of an optical propagation material.
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	88. The wavelength-selective optical transmission system of claim 46
	wherein:
	said Bragg gratings comprising a periodic variation of a structura
	characteristic of an optical propagation material.
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	89. The wavelength-selective optical transmission system of claim 46
	wherein:
	said Bragg gratings comprising a periodic variation of a structura
	characteristic and a refractive index of an optical propagation
15	material.
	90. The wavelength-selective optical transmission system of claim 46
	wherein:
	at least one of said first and second waveguides are manufactured
20	on a substrate by applying an integrated circuit (IC) manufacturing
	process thereon.
	91. A wavelength-selective optical transmission system comprising:
25	a first and a second waveguides;
	said second waveguide disposed on a vertically stacked position or
	said first waveguide and at least one of said first and second
	waveguides having a set of wavelength-selective Bragg gratings
30 .	disposed near a coupling section between said first and second
	waveguides wherein said first and second waveguides having
	different optical propagation constants.

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wherein:

said Bragg gratings comprising a periodic variation of a refractive index of an optical propagation material.

92. The wavelength-selective optical transmission system of claim 91 $\,$

	95. The wavelength-selective optical transmission system of claim 71
	wherein:
	said Bragg gratings comprising a periodic variation of a structural
	characteristic of an optical propagation material.
5	04. The averaglementh colorative autical transmission system of claim 01
	94. The wavelength-selective optical transmission system of claim 91 wherein:
10	said Bragg gratings comprising a periodic variation of a structural characteristic and a refractive index of an optical propagation material.
	95. The wavelength-selective optical transmission system of claim 91 wherein:
15	at least one of said first and second waveguides are manufactured on a substrate by applying an integrated circuit (IC) manufacturing process thereon.
	96. The wavelength-selective optical transmission system of claim 91 wherein:
20	said Bragg gratings disposed on said first waveguide.
	97. The wavelength-selective optical transmission system of claim 91 wherein:
25	said Bragg gratings disposed on said second waveguide.
- 	98. The wavelength-selective optical transmission system of claim 91 wherein:
	said Bragg gratings disposed on said first and second waveguides.
30	99. The wavelength-selective optical transmission system of claim 91 wherein:
	said Bragg gratings disposed on a cladding surrounding said first waveguide.

100. The wavelength-selective optical transmission system of claim 91 wherein:

said Bragg gratings disposed on a cladding surrounding said second waveguide.

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101. The wavelength-selective optical transmission system of claim 91 wherein:

said Bragg gratings disposed on a cladding in a gap between said first and second waveguides.